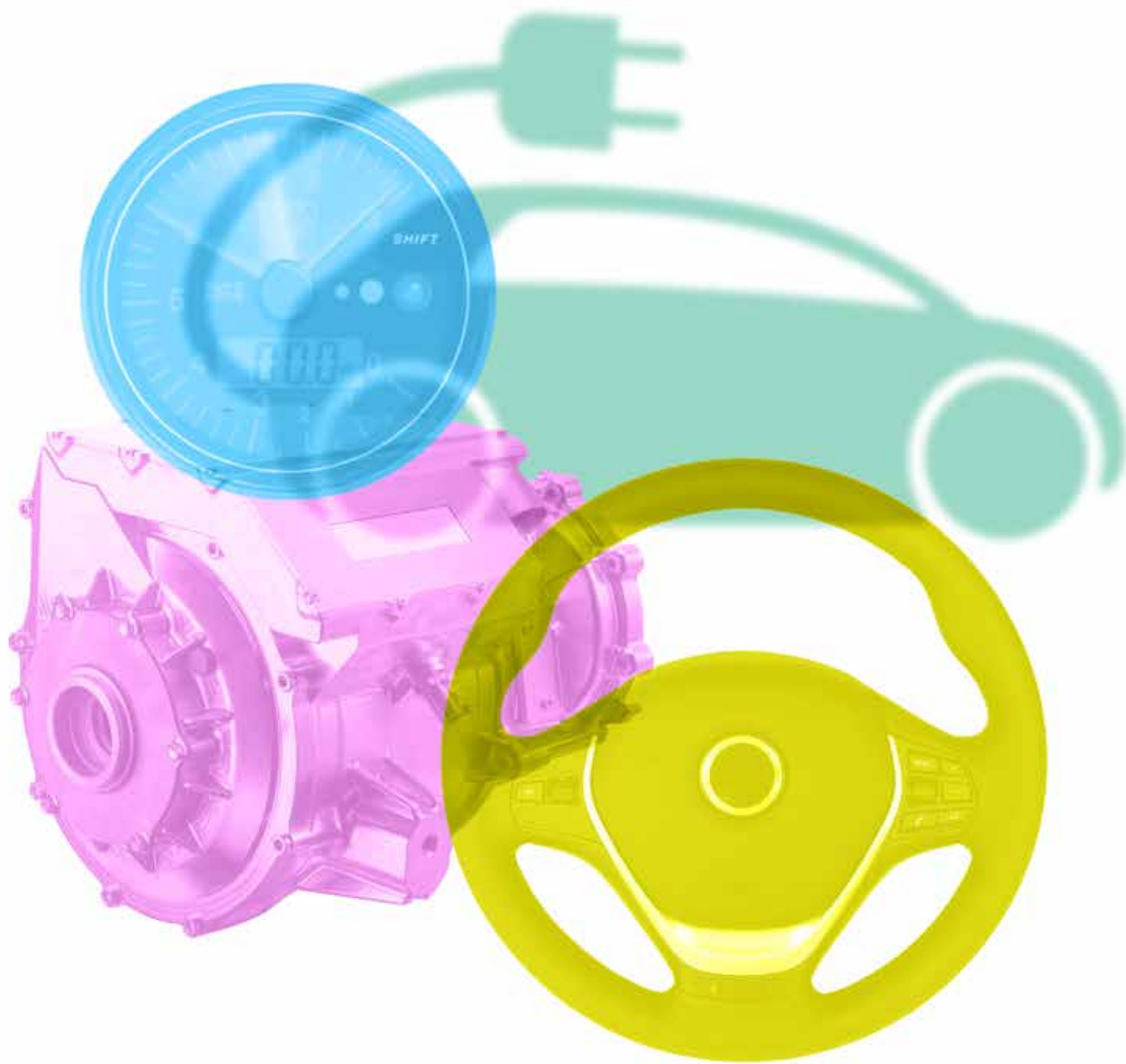


AEC-Q200 ***Automotive Grade*** ***Capacitors***



DLI•JohansonMFG•Novacap•Syfer•Voltronics

AEC-Q200 Automotive Grade Capacitors

At Knowles Capacitors we manufacture Single Layer, Multilayer, High Reliability and Precision Variable Capacitors; EMI Filters and Thin Film Devices.

One of our fields of expertise is the design and manufacture of components important to engineers in the automotive industry. Today's vehicles have many electronic control units that enable absolute precision and control.

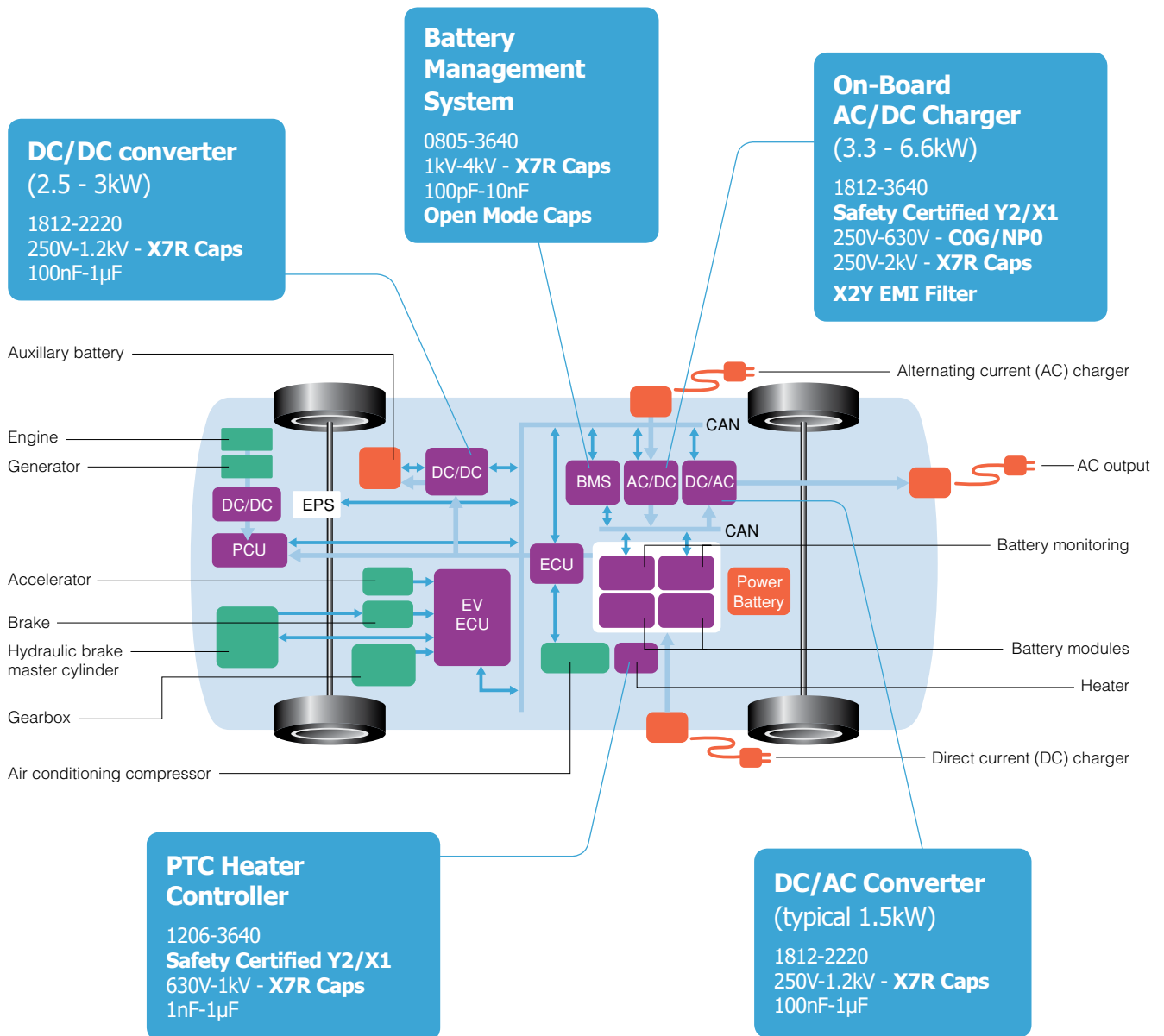
The Automotive Electronics Council (AEC) Component Technical Committee is the standardization body for establishing standards for reliable, high quality electronic components. Components meeting these specifications are suitable for use in the harsh automotive environment without additional component-level qualification testing.

The Component Technical Committee established AEC-Q200 "Stress Test Qualification for Passive Components" to define the

minimum stress test driven qualification requirements for passive electrical devices including ceramic capacitors.

Knowles has developed a range of MLC capacitors and surface mount EMI filters qualified to AEC-Q200 rev D to meet the needs of high reliability and automotive manufacturers.

Please refer to the following pages for details of the product ranges offered by Knowles.



Electric Vehicle Charging - EV/HEV/PHEV

Automotive Grade Capacitors - AEC-Q200 range

We offer a range of high quality automotive grade components. With AEC-Q200 approved ranges up to a voltage rating of 1kV we provide for the requirements of modern automotive applications including EV and HEV.

Ranges include :-

1. Standard MLCCs
2. StackiCap™ - large capacitance/small case size MLCCs
3. Open Mode and Tandem capacitors
4. 3 terminal EMI components
5. X2Y Integrated Passive Component
6. X8R high temperature MLCCs
7. Safety Certified MLCCs

All fully tested / approved and available with a range of suitable termination options, including tin/lead plating and Knowles FlexiCap™.



AEC-Q200 MLCC range - maximum capacitance values

		0603	0805	1206	1210	1808	1812	1825	2220	2225	3640			
							StackiCap™ 3.2mm max thickness			StackiCap™ 4.2mm max thickness				
50/ 63V	COG/NPO	1nF	4.7nF	15nF	27nF	27nF	47nF	-	82nF	100nF	-	150nF	220nF	-
	X7R	100nF *	220nF	470nF	1µF	-	2.2µF	-	2.2µF	3.3µF	-	3.3µF	4.7µF	-
100V	COG/NPO	470pF	2.2nF	8.2nF	15nF	15nF	39nF	-	47nF	56nF	-	68nF	180nF	-
	X7R	47nF	100nF	220nF	680nF	-	1µF	-	1.5µF	1.5µF	-	2.2µF	3.3µF	-
200/ 250V	X8R	-	33nF	100nF	220nF	220nF	470nF	-	-	1.0µF	-	1.5µF	-	-
	COG/NPO	220pF	1nF	3.3nF	8.2nF	8.2nF	18nF	-	27nF	33nF	-	33nF	82nF	-
500V	X7R	10nF	47nF	150nF	330nF	-	680nF	1.0µF	1.0µF	1.0µF	2.2µF	1.5µF	1.5µF	5.6µF
	X8R	-	15nF	68nF	150nF	150nF	330nF	-	-	680nF	-	1.0µF	-	-
630V	COG/NPO	-	680pF	2.7nF	6.8nF	5.6nF	15nF	-	18nF	22nF	-	22nF	56nF	-
	X7R	-	15nF	68nF	150nF	-	330nF	470nF	560nF	560nF	1.2µF	680nF	1.0µF	2.7µF
1kV	X8R	-	4.7nF	22nF	47nF	47nF	120nF	-	-	330nF	-	470nF	-	-
	COG/NPO	-	560pF	2.7nF	6.8nF †	5.6nF	15nF	-	10nF	15nF	-	15nF	39nF	-
1.2kV	X7R	-	10nF	47nF	100nF	-	150nF	330nF	200nF	330nF	1.0µF	390nF	680nF	2.2µF
	X8R	-	2.2nF	10nF	33nF	33nF	68nF	-	-	180nF	-	220nF	-	-
1.5kV	COG/NPO	-	150pF	1.5nF	2.2nF	2.2nF	5.6nF	-	10nF	10nF	-	10nF	22nF	-
	X7R	-	3.3nF	10nF	47nF	-	68nF	180nF	200nF	120nF	470nF	150nF	180nF	1.0µF
2kV	X8R	-	1.5nF	3.3nF	6.8nF	6.8nF	27nF	-	-	68nF	-	82nF	-	-
	COG/NPO	-	68pF	390pF	680pF	1.0nF	3.3nF	-	4.7nF	4.7nF	-	6.8nF	18nF	-
2.5kV	X7R	-	-	3.3nF	18nF	-	33nF	100nF	68nF	82nF	220nF	100nF	150nF	470nF
	X8R	-	-	2.2nF	5.6nF	5.6nF	15nF	-	-	47nF	-	56nF	-	-
3kV	COG/NPO	-	68pF	390pF	680pF	680pF	2.2nF	-	3.9nF	4.7nF	-	4.7nF	12nF	-
	X7R	-	-	2.7nF	6.8nF	-	22nF	56pF	47nF	47nF	150nF	68nF	100nF	330nF
3kV	X8R	-	-	1.5nF	3.3nF	3.3nF	10nF	-	-	27nF	-	33nF	-	-
	COG/NPO	-	47pF	220pF	390pF	470pF	1.5nF	-	1.8nF	2.2nF	-	2.2nF	5.6nF	-
3kV	X7R	-	-	2.2nF	4.7nF	-	10nF	33pF	10nF	27nF	100nF	33nF	47nF	150nF
	X8R	-	-	680pF	1.5nF	1.5nF	5.6nF	-	-	15nF	-	22nF	-	-
3kV	COG/NPO	-	-	100pF	180pF	270pF	680pF	-	-	1.5nF	-	-	-	-
	X8R	-	-	-	-	1.2nF	3.3nF	-	-	10nF	-	12nF	-	-
3kV	COG/NPO	-	-	68pF	150pF	220pF	470pF	-	-	1nF	-	-	-	-
	X8R	-	-	-	-	820pF	2.7nF	-	-	5.6nF	-	6.8nF	-	-

Notes: 1) * 0603 Max thickness 0.9mm above 56nF, FB6 suffix code. 2) † 1210 Max thickness 2.2mm as suffix AG1. 3) See page 6 for full details of the StackiCap™ range.

Safety Certified Capacitors

Dielectric	Approval Body	X1 PY2		X2 SP	Y2/X1 SP		Y2/X1 B16	X2 B17
		1808	1812	1808	2211	2215	2220	2220
COG/NPO	TÜV, UL	4.7pF - 390pF	4.7pF - 470pF	4.7pF - 1.5nF	4.7pF - 1.0nF	820pF - 1.0nF	-	-
X7R	TÜV, UL	150pF - 1nF	150pF - 2.2nF	150pF - 4.7nF	100pF - 3.9nF	2.7nF - 3.9nF	150pF - 10nF	150pF - 22nF (TÜV approval only)

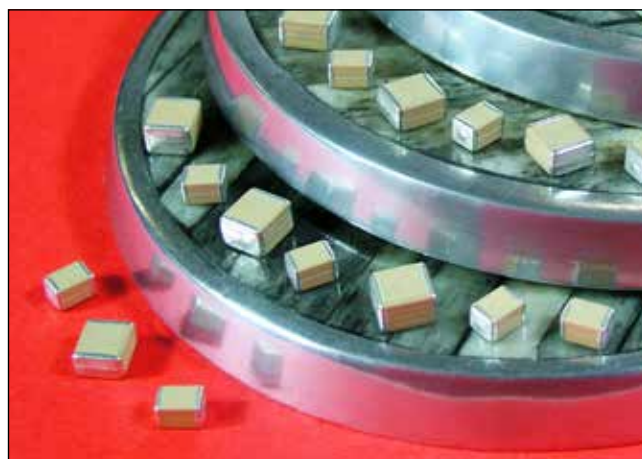
Note: See pages 7, 8 and 9 for full details of 250Vac Safety Certified AC Capacitors and ordering information.

StackiCap™ Capacitors - X7R

The StackiCap™ range offers a significant reduction in 'PCB real estate' for an equivalent capacitance value when board space is at a premium. For example, a standard 150nF chip in a 8060 case size is now available in a much smaller 3640 case size.

Knowles's unique patented* construction and FlexiCap™ termination material make the StackiCap™ range suitable for applications including: power supplies, lighting, aerospace electronics and high voltage applications where a large amount of capacitance is required. Further developments are on-going, please contact the Sales Office for details of the full range.

* StackiCap™ technology is protected by international patents (pending) EP2847776, WO2013186172A1, US20150146343A1 and CN104471660A.



Maximum capacitance

Up to 5.6µF

Maximum voltage

Up to 2kV

Insulation resistance

Time Constant (RxCr) (whichever is the least - 500s or 500MΩ)

Maximum capacitance values - StackiCap™ Capacitors

Chip size	1812	2220	3640
Thickness max.	3.2mm	4.2mm	4.2mm
200/250V	1.0µF	2.2µF	5.6µF
500V	470nF	1.2µF	2.7µF
630V	330nF	1.0µF	2.2µF
1kV	180nF	470nF	1.0µF
1.2kV	100nF	220nF	470nF
1.5kV	56nF	150nF	330nF
2kV	33nF	100nF	150nF

☐ = AEC-Q200

Ordering information - StackiCap™ Capacitors

1812	Y	500	0474	K	J	T	WS2
Chip size	Termination	Voltage	Capacitance in picofarads (pF)	Capacitance tolerance	Dielectric	Packaging	Suffix code
1812 2220 3640	Y = FlexiCap™ termination base with nickel barrier (100% matte tin plating). RoHS compliant. Lead free. H = FlexiCap™ Termination base with nickel barrier (Tin/lead plating with minimum 10% lead). Not RoHS compliant.	200/250 = 200/250V 500 = 500V 630 = 630V 1K0 = 1kV 1K2 = 1.2kV 1K5 = 1.5kV 2K0 = 2kV	First digit is 0. Second and third digits are significant figures of capacitance code in picofarads (pF). Fourth digit is number of zeros eg. 0474 = 470nF Values are E12 series	J = ±5% K = ±10% M = ±20%	J = X7R (BME) E = X7R (2R1) AEC-Q200 S = X7R (BME) AEC-Q200 X = X7R	T = 178mm (7") reel R = 330mm (13") reel B = Bulk pack - tubs or trays	WS2

Reeled quantities - StackiCap™ Capacitors

	1812	2220	3640
178mm (7") Reel	500	500	-
330mm (13") Reel	2,000	2,000	500



Note: Parts in this range may be defined as dual-use under export control legislation as such may be subject to export licence restrictions.

Please refer to page 12 of the Knowles MLC Capacitors catalogue for more information on the dual-use regulations and contact the Sales Office for further information on specific part numbers.

250Vac Safety Certified AC Capacitors - Certification Chart

Classification and approval specification - Safety Certified capacitors

CHIP SIZE	SUFFIX CODE	DIELECTRIC	CAP RANGE	CLASSIFICATION	APPROVAL SPECIFICATION	APPROVAL BODY	AEC-Q200
1808	SP ⁽¹⁾	COG/NP0	4.7pF to 1.5nF	<u>X2</u> NWGQ2, NWGQ8	IEC60384-14 EN60384-14 UL-60950-1, 2nd Ed CSA 60950-1-07 2nd Ed	TÜV UL	TÜV & UL FULL RANGE
1808	SP ⁽¹⁾	X7R	150pF to 4.7nF	<u>X2</u> NWGQ2, NWGQ8	IEC60384-14 EN60384-14 UL-60950-1, 2nd Ed CSA 60950-1-07 2nd Ed	TÜV UL	TÜV & UL FULL RANGE 'Y' TERM ONLY
1808	PY2 ⁽¹⁾	COG/NP0	4.7pF to 390pF	<u>X1</u> NWGQ2, NWGQ8	IEC60384-14 EN60384-14 UL-60950-1, 2nd Ed CSA 60950-1-07 2nd Ed	TÜV UL	TÜV & UL FULL RANGE
1808	PY2 ⁽¹⁾	X7R	150pF to 1nF	<u>X1</u> NWGQ2, NWGQ8	IEC60384-14 EN60384-14 UL-60950-1, 2nd Ed CSA 60950-1-07 2nd Ed	TÜV UL	TÜV & UL 1nF max. 'Y' TERM ONLY
1812	PY2 ⁽¹⁾	COG/NP0	4.7pF to 390pF	<u>X1</u> NWGQ2, NWGQ8	IEC60384-14 EN60384-14 UL-60950-1, 2nd Ed CSA 60950-1-07 2nd Ed	TÜV UL	TÜV & UL FULL RANGE
1812	PY2 ⁽¹⁾	X7R	150pF to 2.2nF	<u>X1</u> NWGQ2, NWGQ8	IEC60384-14 EN60384-14 UL-60950-1, 2nd Ed CSA 60950-1-07 2nd Ed	TÜV UL	TÜV & UL 2.2nF max. 'Y' TERM ONLY
2211	SP ⁽²⁾	COG/NP0	4.7pF to 1nF	<u>Y2/X1</u> NWGQ2, NWGQ8	IEC60384-14 EN60384-14 UL-60950-1, 2nd Ed CSA 60950-1-07 2nd Ed	TÜV UL	TÜV & UL FULL RANGE
2211	SP ⁽²⁾	X7R	100pF to 3.9nF	<u>Y2/X1</u> NWGQ2, NWGQ8	IEC60384-14 EN60384-14 UL-60950-1, 2nd Ed CSA 60950-1-07 2nd Ed	TÜV UL	TÜV & UL FULL RANGE 'Y' & 'H' TERM ONLY
2215	SP ⁽²⁾	COG/NP0	820pF to 1.0nF	<u>Y2/X1</u> NWGQ2, NWGQ8	IEC60384-14 EN60384-14 UL-60950-1, 2nd Ed CSA 60950-1-07 2nd Ed	TÜV UL	TÜV & UL FULL RANGE
2215	SP ⁽²⁾	X7R	2.7nF to 3.9nF	<u>Y2/X1</u> NWGQ2, NWGQ8	IEC60384-14 EN60384-14 UL-60950-1, 2nd Ed CSA 60950-1-07 2nd Ed	TÜV UL	TÜV & UL FULL RANGE 'Y' & 'H' TERM ONLY
2220	B16	X7R	150pF to 10nF	<u>Y2/X1</u> FOWX2, FOWX8	IEC60384-14 EN60384-14 UL-60384-14:2010 CSA E60384-14:09	TÜV UL	TÜV & UL FULL RANGE 'Y' & 'H' TERM ONLY
2220	B17 ⁽²⁾	X7R	150pF to 22nF	<u>X2</u>	IEC60384-14 EN60384-14	TÜV	TÜV ONLY 22nF max. 'Y' & 'H' TERM ONLY

Notes: Termination availability

(1) J & Y terminations only.

(2) J, Y, A & H terminations available.

PY2 Unmarked capacitors also available as released in accordance with approval specifications. Suffix Code SY2 applies.

SP Unmarked capacitors also available as released in accordance with approval specifications. Suffix Code SPU applies.

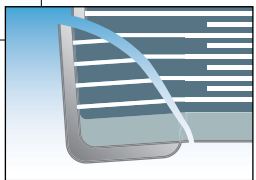
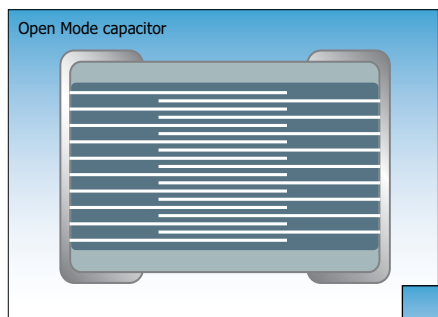


Open Mode and Tandem Capacitors - X7R

Open Mode capacitors have been designed specifically for use in applications where mechanical cracking is a severe problem and short circuits due to cracking are unacceptable.

Open Mode capacitors use inset electrode margins, which prevent any mechanical cracks which may form during board assembly from connecting to the internal electrodes.

When combined with FlexiCap™ termination, Open Mode capacitors provide a robust component with the assurance that if a part becomes cracked, the crack will be unlikely to result in short circuit failure.



Qualification included cracking the components by severe bend tests. Following the bend tests cracked components were subjected to endurance / humidity tests, with no failures evident due to short circuits. Note: Depending on the severity of the crack, capacitance loss was between 0% and 70%.

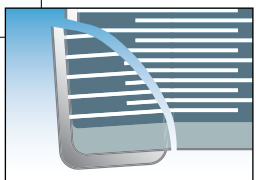
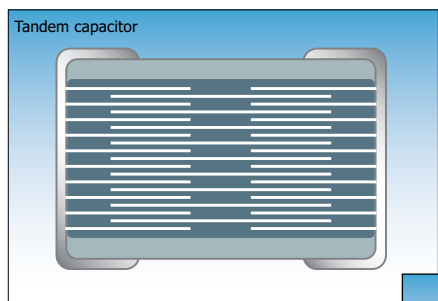
Open Mode max capacitance (X7R only) ■ = AEC-Q200 qualified

	0603	0805	1206	1210	1808	1812	2220	2225
16V	39nF	100nF 150nF	220nF 100nF	470nF 680nF	680nF	1.5µF	3.3µF	4.7µF
25V	33nF	100nF 120nF	220nF 330nF	470nF 560nF	560nF	1.2µF	2.2µF	3.9µF
50/63V	22nF	100nF	220nF	470nF	470nF	1.0µF	1.5µF	2.7µF
100V	6.8nF	27nF	100nF	220nF	220nF	680nF	1.0µF	1.5µF 1.8µF
200/250V	2.7nF	15nF	68nF	100nF	100nF	330nF	680nF	1.0µF
500V	-	5.6nF	39nF	68nF	68nF	180nF	330nF	390nF
630V	-	-	22nF	33nF	27nF	100nF	180nF	220nF
1kV	-	-	6.8nF	15nF	15nF	47nF	100nF	100nF

Tandem Capacitors have been designed as a fail safe range using a series section internal design, for use in any application where short circuits would be unacceptable.

When combined with FlexiCap™ termination, Tandem capacitors provide an ultra robust and reliable component, for use in the most demanding applications.

Non-standard voltages are available. For more information please consult the Sales Office.



Qualification included cracking the components by severe bend tests. Following the bend tests cracked components were subjected to endurance / humidity tests, with no failures evident due to short circuits. Note: Depending on the severity of the crack, capacitance loss was between 0% and 50%.

Tandem max capacitance (X7R only) ■ = AEC-Q200 qualified

	0603	0805	1206	1210	1812	2220	2225
16V	12nF	47nF	150nF	270nF	560nF	1.2µF	1.5µF
25V	10nF	39nF	120nF	220nF	470nF	1.0µF	1.2µF
50/63V	6.8nF	33nF	100nF	180nF	390nF	680nF	1.0µF
100V	2.2nF	10nF	47nF	82nF	220nF	470nF	680nF
200/250V	1.0nF	4.7nF	22nF	47nF	100nF	220nF	330nF

Ordering information - Open Mode and Tandem Capacitors

1206	Y	050	0224	K	X	T	---
Chip size	Termination	Voltage	Capacitance in picofarads (pF)	Capacitance tolerance	Dielectric codes	Packaging	Suffix code
0603 0805 1206 1210 1808 1812 2220 2225	Y = FlexiCap™ termination base with nickel barrier (100% matte tin plating). RoHS compliant. *H = FlexiCap™ (Tin/Lead) Not RoHS compliant.	016 = 16V 025 = 25V 050 = 50V 063 = 63V 100 = 100V 200 = 200V 250 = 250V 500 = 500V 630 = 630V 1K0 = 1kV	First digit is 0. Second and third digits are significant figures of capacitance code. The fourth digit is number of zeros following. Example: 0224 = 220000pF	J = ±5% K = ±10% M = ±20%	X = X7R S = X7R BME (AEC-Q200) E = X7R (AEC-Q200 product)	T = 178mm (7") reel R = 330mm (13") reel B = Bulk pack - tubs or trays	M01 = Open Mode capacitor T01 = Tandem capacitor

Note: *FlexiCap™ termination only available in X7R material. Please contact our Sales Office for any special requirements.

Surface Mount EMI Filters - E01 & E07 feedthrough capacitors

The Syfer E01 and E07 ranges of feedthrough MLCC chip 'C' filters are 3 terminal chip devices designed to offer reduced inductance compared to conventional MLCCs when used in signal line filtering.

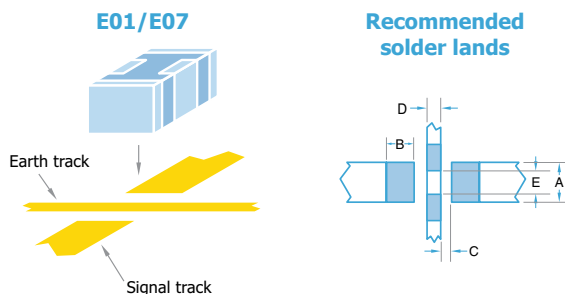
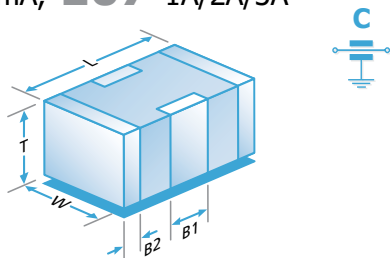
The filtered signal passes through the chip internal electrodes and the noise is filtered to the grounded side contacts, resulting in reduced length noise transmission paths.

Available in COG/NPO and X7R dielectrics, with current ratings of 300mA, 1A, 2A, 3A and voltage ratings of 25Vdc to 200Vdc. Also available with FlexiCap™ termination which is strongly recommended for new designs.

Commonly used in automotive applications, a range qualified to AEC-Q200 is also available.



E01 300mA, E07 1A/2A/3A



Dimensions

	0805	1206	1806	1812
L	2.0 ± 0.3 (0.079 ± 0.012)	3.2 ± 0.3 (0.126 ± 0.012)	4.5 ± 0.35 (0.177 ± 0.014)	4.5 ± 0.35 (0.177 ± 0.014)
W	1.25 ± 0.2 (0.049 ± 0.008)	1.6 ± 0.2 (0.063 ± 0.008)	1.6 ± 0.2 (0.063 ± 0.008)	3.2 ± 0.3 (0.126 ± 0.012)
T	1.0 ± 0.15 (0.039 ± 0.006)	1.1 ± 0.2 (0.043 ± 0.008)	1.1 ± 0.2 (0.043 ± 0.008)	2.0 ± 0.3 (0.079 ± 0.012)
B1	0.60 ± 0.2 (0.024 ± 0.008)	0.95 ± 0.3 (0.037 ± 0.012)	1.4 ± 0.3 (0.055 ± 0.012)	1.45 ± 0.35 (0.055 ± 0.012)
B2	0.3 ± 0.15 (0.012 ± 0.006)	0.5 ± 0.25 (0.02 ± 0.01)	0.5 ± 0.25 (0.02 ± 0.01)	0.75 ± 0.25 (0.02 ± 0.01)

	0805	1206	1806	1812
A	0.95 (0.037)	1.20 (0.047)	1.2 (0.047)	2.65 (0.104)
B	0.90 (0.035)	0.90 (0.035)	1.40 (0.055)	1.40 (0.055)
C	0.30 (0.012)	0.60 (0.024)	0.80 (0.031)	0.80 (0.031)
D	0.40 (0.016)	0.80 (0.031)	1.40 (0.055)	1.40 (0.055)
E	0.75 (0.030)	1.0 (0.039)	1.0 (0.039)	2.05 (0.080)

- Notes: 1) All dimensions mm (inches).
 2) Pad widths less than chip width gives improved mechanical performance.
 3) The solder stencil should place 4 discrete solder pads. The unprinted distance between ground pads is shown as dim E.
 4) Insulating the earth track underneath the filters is acceptable and can help avoid displacement of filter during soldering but can result in residue entrapment under the chip.

Standard Range - E01 & E07 Feedthrough Capacitors

Type		E01			E07			
Chip Size		0805	1206	1806	0805	1206	1806	1812
Max Current		300mA	300mA	300mA	1A	2A	2A	3A
Rated Voltage	Dielectric	Minimum and maximum capacitance values						
25Vdc	COG/NPO	180pF-1.5nF	560pF-3.9nF	820pF-4.7nF	180pF-1.5nF	560pF-3.9nF	820pF-4.7nF	-
	X7R	470pF-100nF	5.6nF-330nF	3.9nF-560nF	820pF-100nF	10nF-330nF	22nF-560nF	560nF-1.8µF
50Vdc	COG/NPO	22pF-820pF	22pF-3.3nF	22pF-3.9nF	10pF-220pF	22pF-1nF	100pF-1.5nF	-
	X7R	560pF-68nF	4.7nF-220nF	3.3nF-330nF	1nF-68nF	10nF-220nF	22nF-330nF	330nF-1.5µF
100Vdc	COG/NPO	22pF-560pF	22pF-2.2nF	22pF-3.3nF	10pF-120pF	22pF-560pF	100pF-680pF	-
	X7R	560pF-27nF	1.8nF-100nF	3.3nF-180nF	1nF-27nF	10nF-100nF	22nF-180nF	180nF-820nF
200Vdc	COG/NPO	-	560pF-1.2nF	56pF-1nF	-	15pF-180pF	56pF-470pF	-
	X7R	-	2.7nF-56nF	3.9nF-100nF	-	12nF-56nF	22nF-100nF	100nF-270nF

Note: E07 25Vdc COG/NPO 1206 and 1806 ranges in green, have maximum current of 1A.

AEC-Q200 Qualified Range - E01 & E07 Feedthrough Capacitors - maximum capacitance values

Type		E01			E07		
Chip Size		0805	1206	1806	0805	1206	1806
50V	COG/NPO	820pF	1nF	2.2nF	220pF	1nF	1.5nF
	X7R	47nF	100nF	200nF	47nF	100nF	200nF
100V	COG/NPO	560pF	1nF	2.2nF	120pF	560pF	680pF
	X7R	15nF	15nF	68nF	15nF	15nF	68nF

Notes: ■ = AEC-Q200. For some lower capacitance parts, higher voltage rated parts may be supplied.

Surface Mount EMI Filters - E03 X2Y Integrated Passive Components

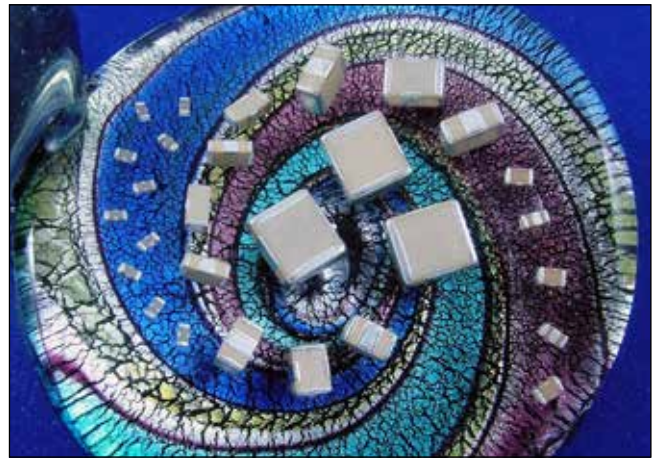
The Syfer X2Y Integrated Passive Component is a 3 terminal EMI chip device.

When used in balanced line applications, the revolutionary design provides simultaneous line-to-line and line-to-ground filtering, using a single ceramic chip. In this way, differential and common mode filtering are provided in one device.

For unbalanced applications, it provides ultra low ESL (equivalent series inductance). Capable of replacing 2 or more conventional devices, it is ideal for balanced and unbalanced lines, twisted pairs and dc motors, in automotive, audio, sensor and other applications.

Available in sizes from 0805 to 1812, these filters can prove invaluable in meeting stringent EMC demands.

Manufactured by Knowles Capacitors under licence from X2Y Attenuators LLC.



Dielectric

X7R or COG/NP0

Electrical configuration

Multiple capacitance

Capacitance measurement

At 1000hr point

Typical capacitance matching

Better than 5%
(down to 1% available on request)

Temperature rating

-55°C to 125°C

Insulation resistance

100Gohms or 1000s (whichever is the less)

Dielectric withstand voltage

≤200V 2.5 times rated Volts for 5 secs
500V 1.5 times rated Volts for 5 secs
Charging current limited to 50mA Max.

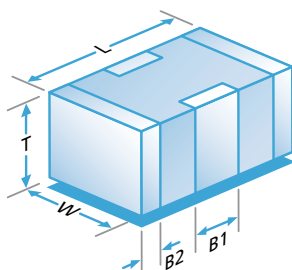
Type		E03			
Chip size		0805	1206	1410	1812
Rated voltage	Dielectric				
25Vdc	COG/NP0	560pF - 820pF	1.8nF - 3.3nF	6.8nF - 8.2nF	12nF - 15nF
	X7R	56nF - 68nF	-	470nF	820nF
50Vdc	COG/NP0	390pF - 470pF	1.2nF - 1.5nF	4.7nF - 5.6nF	8.2nF - 10nF
	X7R	18nF - 47nF	56nF - 220nF	180nF - 400nF	390nF - 680nF
100Vdc	COG/NP0	10pF - 330pF	22pF - 1.0nF	100pF - 3.9nF	820pF - 6.8nF
	X7R	470pF - 15nF	1.5nF - 47nF	4.7nF - 150nF	8.2nF - 330nF
200Vdc	COG/NP0	-	22pF - 1.0nF	100pF - 3.3nF	820pF - 5.6nF
	X7R	-	820pF - 33nF	1.2nF - 120nF	2.7nF - 180nF
500Vdc	COG/NP0	-	-	-	820pF - 3.9nF
	X7R	-	-	-	2.7nF - 100nF

Note: For some lower capacitance parts, higher voltage rated parts may be supplied.

AEC-Q200 range (E03) - capacitance values

Chip size		0805	1206	1410	1812
50Vdc	COG/NP0	390pF - 470pF	1.2nF - 1.5nF	4.7nF - 5.6nF	8.2nF - 10nF
	X7R	18nF - 33nF	56nF - 150nF	180nF - 330nF	390nF - 560nF
100Vdc	COG/NP0	10pF - 330pF	22pF - 1.0nF	100pF - 3.9nF	820pF - 6.8nF
	X7R	470pF - 15nF	1.5nF - 47nF	4.7nF - 150nF	8.2nF - 330nF

Note: ■ = AEC-Q200.



	0805	1206	1410	1812
L	2.0±0.3 (0.08±0.012)	3.2±0.3 (0.126±0.012)	3.6±0.3 (0.14±0.012)	4.5±0.35 (0.18±0.014)
W	1.25±0.2 (0.05±0.008)	1.60±0.2 (0.063±0.008)	2.5±0.3 (0.1±0.012)	3.2±0.3 (0.126±0.012)
T	1.0±0.15 (0.04±0.006)	1.1±0.2 (0.043±0.008)	2.0 max. (0.08 max.)	2.1 max. (0.08 max.)
B1	0.5±0.25 (0.02±0.01)	0.95±0.3 (0.037±0.012)	1.20±0.3 (0.047±0.012)	1.4±0.35 (0.06±0.014)
B2	0.3±0.15 (0.012±0.006)	0.5±0.25 (0.02±0.01)	0.5±0.25 (0.02±0.01)	0.75±0.25 (0.03±0.01)

- Notes: 1) All dimensions mm (inches).
2) Pad widths less than chip width gives improved mechanical performance.
3) The solder stencil should place 4 discrete solder pads. The un-printed distance between ground pads is shown as dim E.
4) Insulating the earth track underneath the filters is acceptable and can help avoid displacement of filter during soldering but can result in residue entrapment under the chip.



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Knowles Capacitors designs, manufactures and sells special electronic components. Our products are used in military, space, telecom infrastructure, medical and industrial applications where function and reliability are crucial.



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